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EXAMINER	
SALAZAR, LUIS A	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/019,883	Applicant(s) YUAN ET AL.	
	Examiner LUIS A. SALAZAR	Art Unit 4192	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 March 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 March 2007* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claims 1-5 are objected to because of the following informalities:

In claim 1, line 7, "a phoneme cluster" should be changed to --the phoneme cluster-- in order to provide proper antecedent basis. Claims 2-5 are objected because they are dependent on objected claim 1.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-15 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Kao et al. (U.S. Patent: 6,317,712 B1), hereinafter referred as Kao, in view of Yan (U.S. Patent: 6,789,063 B1).

2. As per claim 1, Kao teaches a speech processing method comprising: receiving speech signals (Kao, figure 3, subblock 11); processing the received speech signals (Kao, figure 3, subblock 12 and 13); to generate a plurality of phoneme clusters (Kao, figure 3,

subblock 14); grouping the phoneme clusters into a first cluster node and a second cluster node (Kao, figure 3, subblock 14; figure 4).

Kao does not explicitly teach determining automatically if a phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phone cluster of the first cluster node from being in the first cluster node to being in the second cluster node. However, Yan teaches determining automatically if a phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phone cluster of the first cluster node from being in the first cluster node to being in the second cluster node (Yan, col. 1, lines 40-58 and col.3, lines 5-8). ("A set of states can be recursively partitioned into subsets according to the answers to the questions at each node when traversing the tree from the root node to its leaf nodes. All states that reach the same leaf nodes are considered similar and are clustered together. The tree construction is a top-down data driven process based on a one-step greedy tree growing algorithm. The goodness-of-split criterion is based on maximum likelihood (ML) of the training data. Initially all corresponding HMM states of all triphones that share the same basic phone are pooled in the root node and the log-likelihood of the training data is calculated based on the assumption that all the states in the node are tied. This node is then split into two by the question that gives the maximum increase in log-likelihood of the training data when partitioning the states in the node. This process is repeated until the increase falls below a threshold", Yan, col. 1, lines 40-58, "During the decision tree construction, if all the data associated with all the

states in a node is less than a threshold, the node is no longer split and becomes a leaf node", Yan, col.3, lines 5-8).

Kao and Yan are analogous art because they are from a similar field of endeavor in speech processing and large vocabulary speech recognition applications. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the teachings of Yan into Kao since Kao teaches a speech processing method comprising: receiving speech signals (Kao, figure 3, subblock 11); processing the received speech signals (Kao, figure 3, subblock 12 and 13); to generate a plurality of phoneme clusters (Kao, figure 3, subblock 14); grouping the phoneme clusters into a first cluster node and a second cluster node (Kao, figure 3, subblock 14; figure 4) and Yan teaches determining automatically if a phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phone cluster of the first cluster node from being in the first cluster node to being in the second cluster node (Yan, col. 1, lines 40-58 and col.3, lines 5-8), in order to improve the decision-tree based acoustic modeling to better use the training data and thereby to improve the accuracy and robustness of the clustered acoustic models. ("A set of states can be recursively partitioned into subsets according to the answers to the questions at each node when traversing the tree from the root node to its leaf nodes. All states that reach the same leaf nodes are considered similar and are clustered together. The tree construction is a top-down data driven process based on a one-step greedy tree growing algorithm. The goodness-of-split criterion is based on maximum likelihood (ML) of the training

data. Initially all corresponding HMM states of all triphones that share the same basic phone are pooled in the root node and the log-likelihood of the training data is calculated based on the assumption that all the states in the node are tied. This node is then split into two by the question that gives the maximum increase in log-likelihood of the training data when partitioning the states in the node. This process is repeated until the increase falls below a threshold", Yan, col. 1, lines 40-58, "During the decision tree construction, if all the data associated with all the states in a node is less than a threshold, the node is no longer split and becomes a leaf node", Yan, col.3, lines 5-8).

3. As per claim 2, Kao, in view of Yan, teaches the speech processing method as claimed in claim 1, further comprising: moving the phoneme cluster in the first cluster node into the second cluster node if the first cluster node is determined to be moved into the second cluster node (Yan, col.3, lines 5-8). ("During the decision tree construction, if all the data associated with all the states in a node is less than a threshold, the node is no longer split and becomes a leaf node", Yan, col.3, lines 5-8).

4. As per claim 3, Kao, in view of Yan, teaches the speech processing method as claimed in claim 2, wherein moving the phoneme cluster in the first cluster node into the second cluster node includes: moving the first cluster node into the second cluster node if the most likelihood increase is more than a threshold value (Yan, col. 1, lines 40-58 and Yan, col.3, lines 5-8). ("The tree construction is a top-down data driven process based on a one-step greedy tree growing algorithm. The goodness-of-split criterion is based on

maximum likelihood (ML) of the training data. Initially all corresponding HMM states of all triphones that share the same basic phone are pooled in the root node and the log-likelihood of the training data is calculated based on the assumption that all the states in the node are tied. This node is then split into two by the question that gives the maximum increase in log-likelihood of the training data when partitioning the states in the node. This process is repeated until the increase falls below a threshold", Yan, col. 1, lines 40-58, "During the decision tree construction, if all the data associated with all the states in a node is less than a threshold, the node is no longer split and becomes a leaf node", Yan, col.3, lines 5-8).

5. As per claim 4, Kao, in view of Yan, teaches the speech processing method as claimed in claim 1, wherein the phoneme clusters are triphone clusters based on a hidden markov model (HMM) (Kao, col. 3, line 41; "Applicants teach to tie triphone HMMs").

6. As per claim 5, Kao, in view of Yan, teaches the speech processing method as claimed in claim 1, wherein the grouping of the phoneme clusters includes:
grouping the triphone clusters according to answers to best phonetic context based questions related to the triphone clusters (Yan, col. 1, lines 36-44; "The phonetic decision tree is a binary tree in which a yes-no question about the phonetic context is attached to each node. A set of states can be recursively partitioned into subsets according to the answers to the questions at each node when traversing the tree from the root node to its

leaf nodes. All states that reach the same leaf nodes are considered similar and are clustered together").

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7. As per claim 6, Kao teaches a speech processing system comprising: an input to receive speech signals (Kao, figure 1, subblock MIC, figure 2, subblock MIC);
a processing unit to process received speech signals (Kao, figure 3, subblock 12 and 13), to generate a plurality of phoneme clusters from the processed received speech signals (Kao, figure 3, subblock 14), to group the phoneme clusters into a first cluster node and a second cluster node (Kao, figure 3, subblock 14; figure 4).

Kao does not explicitly teach to determine automatically if a phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phone cluster of the first cluster node from being in the first cluster node to being in the second cluster node. However, Yan teaches to determine automatically if a phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phone cluster of the first cluster node from being in the first cluster node to being in the second cluster node (Yan, col. 1, lines 40-58 and Yan, col.3, lines 5-8). ("A set of states can be recursively partitioned into subsets according to the answers to the questions at each node when traversing the tree from the root node to its leaf nodes. All states that reach the same leaf nodes are considered similar and are clustered together. The tree construction is a top-down data driven process based on a one-step greedy tree growing algorithm. The goodness-of-split criterion is based on

maximum likelihood (ML) of the training data. Initially all corresponding HMM states of all triphones that share the same basic phone are pooled in the root node and the log-likelihood of the training data is calculated based on the assumption that all the states in the node are tied. This node is then split into two by the question that gives the maximum increase in log-likelihood of the training data when partitioning the states in the node. This process is repeated until the increase falls below a threshold", Yan, col. 1, lines 40-58, "During the decision tree construction, if all the data associated with all the states in a node is less than a threshold, the node is no longer split and becomes a leaf node", Yan, col.3, lines 5-8).

Kao and Yan are analogous art because they are from a similar field of endeavor in speech processing and large vocabulary speech recognition applications. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the teachings of Yan into Kao since Kao teaches a speech processing system comprising: an input to receive speech signals (Kao, figure 1, subblock MIC, figure 2, subblock MIC); a processing unit to process received speech signals (Kao, figure 3, subblock 12 and 13), to generate a plurality of phoneme clusters from the processed received speech signals (Kao, figure 3, subblock 14), to group the phoneme clusters into a first cluster node and a second cluster node (Kao, figure 3, subblock 14; figure 4) and Yan teaches to determine automatically if a phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phone cluster of the first cluster node from being in the first cluster node

to being in the second cluster node (Yan, col. 1, lines 40-58 and Yan, col.3, lines 5-8), in order to improve the decision-tree based acoustic modeling to better use the training data and thereby to improve the accuracy and robustness of the clustered acoustic models. ("A set of states can be recursively partitioned into subsets according to the answers to the questions at each node when traversing the tree from the root node to its leaf nodes. All states that reach the same leaf nodes are considered similar and are clustered together. The tree construction is a top-down data driven process based on a one-step greedy tree growing algorithm. The goodness-of-split criterion is based on maximum likelihood (ML) of the training data. Initially all corresponding HMM states of all triphones that share the same basic phone are pooled in the root node and the log-likelihood of the training data is calculated based on the assumption that all the states in the node are tied. This node is then split into two by the question that gives the maximum increase in log-likelihood of the training data when partitioning the states in the node. This process is repeated until the increase falls below a threshold", Yan, col. 1, lines 40-58, "During the decision tree construction, if all the data associated with all the states in a node is less than a threshold, the node is no longer split and becomes a leaf node", Yan, col.3, lines 5-8).

8. As per claim 7, Kao, in view of Yan, teaches the speech processing system as claimed in claim 6, wherein the processing unit is to move the phoneme cluster in the first cluster node into the second cluster node if the first cluster node is determined to be moved into the second cluster node (Yan, col.3, lines 5-8). ("During the decision tree

construction, if all the data associated with all the states in a node is less than a threshold, the node is no longer split and becomes a leaf node", col.3, lines 5-8).

9. As per claim 8, Kao, in view of Yan, teaches the speech processing system as claimed in claim 7, wherein the processing unit is to move the first cluster node into the second cluster node if the most likelihood increase is more than a threshold value (Yan, col. 1, lines 40-58 and col.3, lines 5-8). ("The tree construction is a top-down data driven process based on a one-step greedy tree growing algorithm. The goodness-of-split criterion is based on maximum likelihood (ML) of the training data. Initially all corresponding HMM states of all triphones that share the same basic phone are pooled in the root node and the log-likelihood of the training data is calculated based on the assumption that all the states in the node are tied. This node is then split into two by the question that gives the maximum increase in log-likelihood of the training data when partitioning the states in the node. This process is repeated until the increase falls below a threshold", Yan, col. 1, lines 40-58, "During the decision tree construction, if all the data associated with all the states in a node is less than a threshold, the node is no longer split and becomes a leaf node",Yan, col.3, lines 5-8).

10. As per claim 9, Kao, in view of Yan, teaches the speech processing system as claimed in claim 6, wherein the phoneme clusters are triphone clusters based on a hidden markov model (HMM) (Kao, col. 3, line 41; "Applicants teach to tie triphone HMMs").

11. As per claim 10, Kao, in view of Yan, teaches the speech processing system as claimed in claim 9, wherein the processing unit is to group the triphone clusters according to answers to best phonetic context based questions related to the triphone clusters (Yan, col. 1, lines 36-44; "The phonetic decision tree is a binary tree in which a yes-no question about the phonetic context is attached to each node. A set of states can be recursively partitioned into subsets according to the answers to the questions at each node when traversing the tree from the root node to its leaf nodes. All states that reach the same leaf nodes are considered similar and are clustered together").

12. As per claim 11, Kao teaches a machine-readable medium that provides instructions, which if executed by a processor, cause the processor to perform the operations (Kao, col. 2, lines 15-27, figure 1) comprising: receiving speech signals (figure 3, subblock 11); processing the received speech signals (figure 3, subblock 12 and 13); to generate a plurality of phoneme clusters (figure 3, subblock 14); grouping the phoneme clusters into a first cluster node and a second cluster node (figure 3, subblock 14; figure 4).

Kao does not explicitly teach determining automatically if a phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phone cluster of the first cluster node from being in the first cluster node to being in the second cluster node. However, Yan teaches determining automatically if a phoneme cluster in the first cluster node is to be moved into the second cluster node based on a

likelihood increase of the phone cluster of the first cluster node from being in the first cluster node to being in the second cluster node (col. 1, lines 40-58 and col.3, lines 5-8). ("A set of states can be recursively partitioned into subsets according to the answers to the questions at each node when traversing the tree from the root node to its leaf nodes. All states that reach the same leaf nodes are considered similar and are clustered together. The tree construction is a top-down data driven process based on a one-step greedy tree growing algorithm. The goodness-of-split criterion is based on maximum likelihood (ML) of the training data. Initially all corresponding HMM states of all triphones that share the same basic phone are pooled in the root node and the log-likelihood of the training data is calculated based on the assumption that all the states in the node are tied. This node is then split into two by the question that gives the maximum increase in log-likelihood of the training data when partitioning the states in the node. This process is repeated until the increase falls below a threshold", col. 1, lines 40-58, "During the decision tree construction, if all the data associated with all the states in a node is less than a threshold, the node is no longer split and becomes a leaf node", col.3, lines 5-8).

Kao and Yan are analogous art because they are from a similar field of endeavor in speech processing and large vocabulary speech recognition applications. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the teachings of Yan into Kao since Kao teaches a speech processing method comprising: receiving speech signals (figure 3, subblock 11); processing the received speech signals (figure 3, subblock 12 and 13); to generate a plurality of

phoneme clusters (figure 3, subblock 14); grouping the phoneme clusters into a first cluster node and a second cluster node (figure 3, subblock 14; figure 4) and Yan teaches determining automatically if a phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phone cluster of the first cluster node from being in the first cluster node to being in the second cluster node (col. 1, lines 40-58 and col.3, lines 5-8), in order to improve the decision-tree based acoustic modeling to better use the training data and thereby to improve the accuracy and robustness of the clustered acoustic models. ("A set of states can be recursively partitioned into subsets according to the answers to the questions at each node when traversing the tree from the root node to its leaf nodes. All states that reach the same leaf nodes are considered similar and are clustered together. The tree construction is a top-down data driven process based on a one-step greedy tree growing algorithm. The goodness-of-split criterion is based on maximum likelihood (ML) of the training data. Initially all corresponding HMM states of all triphones that share the same basic phone are pooled in the root node and the log-likelihood of the training data is calculated based on the assumption that all the states in the node are tied. This node is then split into two by the question that gives the maximum increase in log-likelihood of the training data when partitioning the states in the node. This process is repeated until the increase falls below a threshold", col. 1, lines 40-58, "During the decision tree construction, if all the data associated with all the states in a node is less than a threshold, the node is no longer split and becomes a leaf node", col.3, lines 5-8).

13. As per claim 12, Kao, in view of Yan, teaches the machine-readable medium of claim 11, further providing instructions, which if executed by a processor, cause the processor to perform the operations comprising: moving the phoneme cluster in the first cluster node into the second cluster node if the first cluster node is determined to be moved into the second cluster node (Yan, col.3, lines 5-8). ("During the decision tree construction, if all the data associated with all the states in a node is less than a threshold, the node is no longer split and becomes a leaf node", col.3, lines 5-8).

14. As per claim 13, Kao, in view of Yan, teaches the machine-readable medium of claim 12, further providing instructions, which if executed by a processor, cause the processor to perform the operations comprising: moving the first cluster node into the second cluster node if the most likelihood increase is more than a threshold value (Yan, col. 1, lines 40-58 and col.3, lines 5-8). ("The tree construction is a top-down data driven process based on a one-step greedy tree growing algorithm. The goodness-of-split criterion is based on maximum likelihood (ML) of the training data. Initially all corresponding HMM states of all triphones that share the same basic phone are pooled in the root node and the log-likelihood of the training data is calculated based on the assumption that all the states in the node are tied. This node is then split into two by the question that gives the maximum increase in log-likelihood of the training data when partitioning the states in the node. This process is repeated until the increase falls below a threshold", Yan, col. 1, lines 40-58, "During the decision tree construction, if all the

data associated with all the states in a node is less than a threshold, the node is no longer split and becomes a leaf node”,Yan, col.3, lines 5-8).

15. As per claim 14, Kao, in view of Yan, teaches the machine-readable medium of claim 11, further providing instructions, which if executed by a processor, cause the processor to perform the operations comprising: processing the received speech signals to generate a plurality of phoneme clusters that are triphone clusters based on a hidden markov model (HMM) (Kao, col. 3, line 41; “Applicants teach to tie triphone HMMs”).

16. As per claim 15, Kao, in view of Yan, teaches the machine-readable medium of claim 14, further providing instructions, which if executed by a processor, cause the processor to perform the operations comprising: grouping the triphone clusters according to answers to best phonetic context based questions related to the triphone clusters (Yan, col. 1, lines 36-44; “The phonetic decision tree is a binary tree in which a yes-no question about the phonetic context is attached to each node. A set of states can be recursively partitioned into subsets according to the answers to the questions at each node when traversing the tree from the root node to its leaf nodes. All states that reach the same leaf nodes are considered similar and are clustered together”).

Conclusion

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LUIS A. SALAZAR whose telephone number is (571)270-5250. The examiner can normally be reached on Monday-Friday.
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pankaj Kumar can be reached on (571)272-6000. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

LS

/Pankaj Kumar/

Supervisory Patent Examiner, Art Unit 4192